

[54] **FLEXIBLE GUIDING TRACK AND RELEASE MECHANISM FOR AN OVERHEAD ROLLING DOOR ASSEMBLY**

[75] Inventor: **James N. Shepard, Concord, Calif.**

[73] Assignee: **United States Steel Corporation, Pittsburgh, Pa.**

[22] Filed: **May 23, 1975**

[21] Appl. No.: **580,387**

[52] U.S. Cl. .... **160/133; 49/457; 160/194; 160/201**

[51] Int. Cl.<sup>2</sup> ..... **E06B 9/14**

[58] Field of Search ..... **160/133, 182, 194, 201, 160/215, 216, 217, 271, 270; 49/454, 456, 457; 16/94 R**

[56] **References Cited**

**UNITED STATES PATENTS**

1,732,850	10/1929	Levan	49/457
2,091,299	8/1937	Bagley et al.	160/201 X
3,118,702	1/1964	Kale et al.	160/201 X
3,430,677	3/1969	Pierce	160/271 X
3,837,041	9/1974	Modert et al.	160/201 X

**FOREIGN PATENTS OR APPLICATIONS**

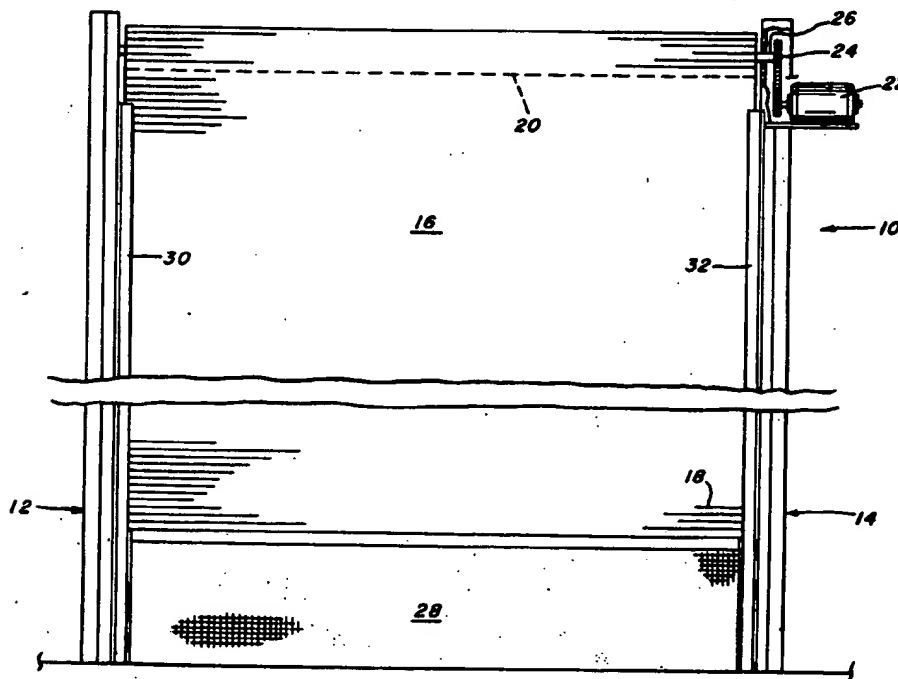
612,938 1/1961 Canada ..... 160/201

*Primary Examiner*—Philip C. Kannan  
*Attorney, Agent, or Firm*—William A. Danchuk

[57] **ABSTRACT**

A sectional door assembly, of the variety having a plurality of interconnected sections which are movable between a closed position and an open position. A flexible guide track is included on both sides of the door for guiding and supporting the plurality of sections between their respective open and closed positions. The flexible nature of the guide track, as well as the incorporation of a relatively quick release mechanism for retaining the guide track on the door's frame, allows for both minimization of damage to the door sections themselves and the time required to repair the door sections if they are accidentally damaged.

**5 Claims, 4 Drawing Figures**



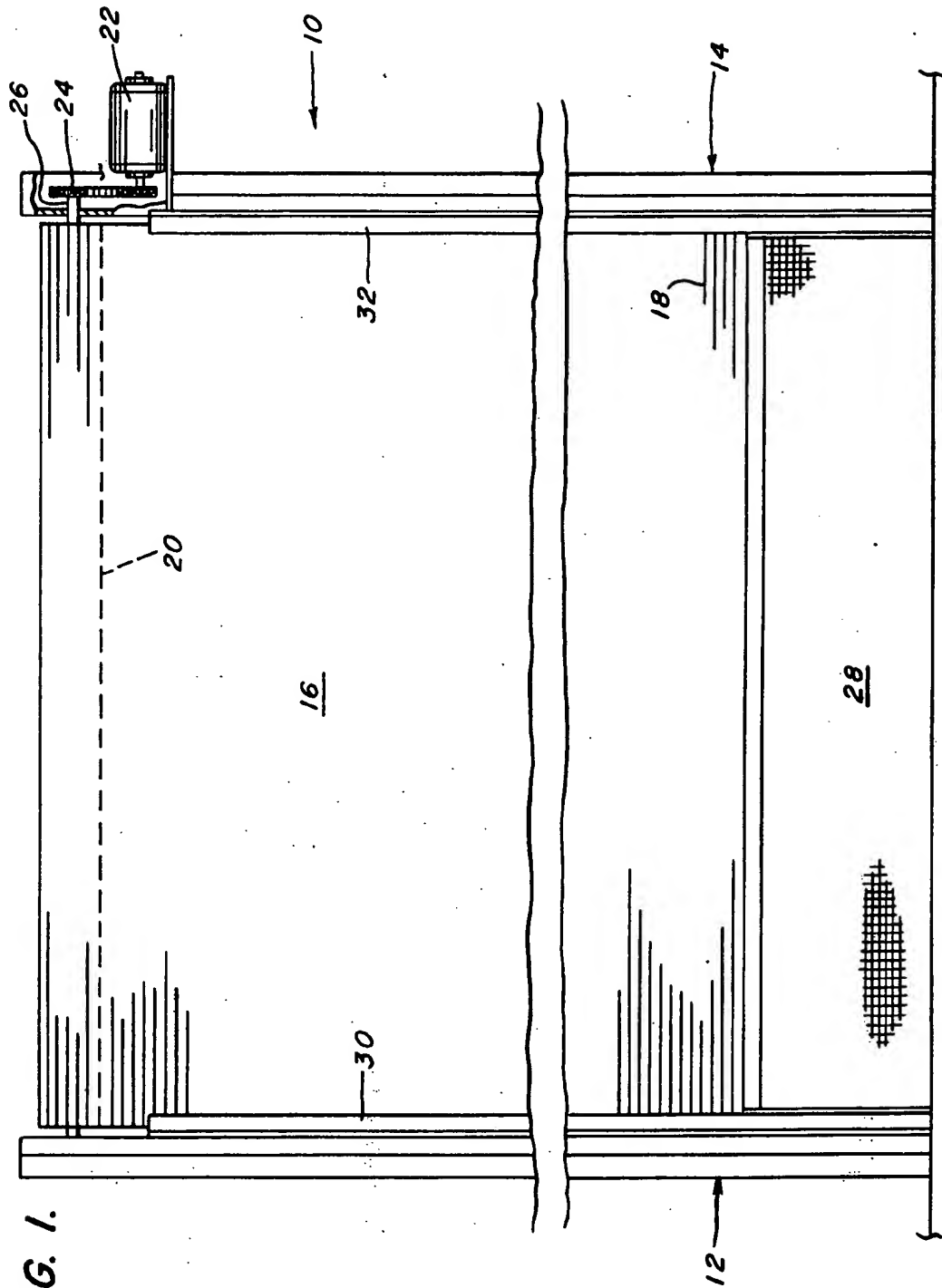


FIG. 1.

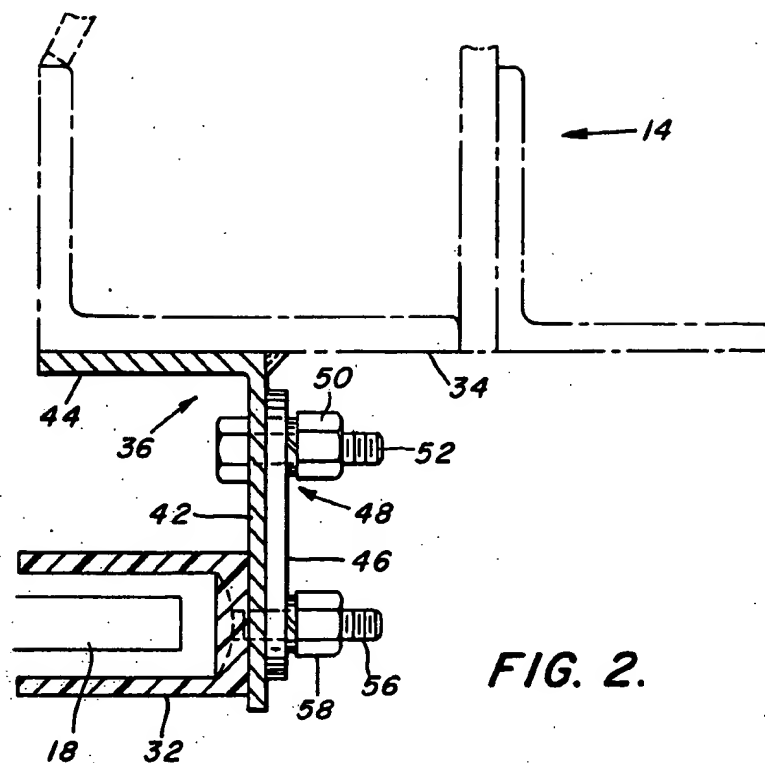


FIG. 2.

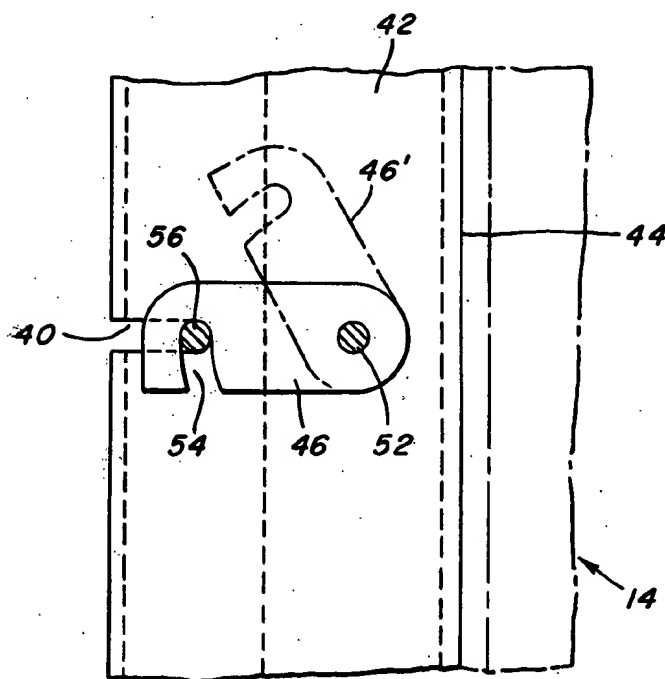


FIG. 3.

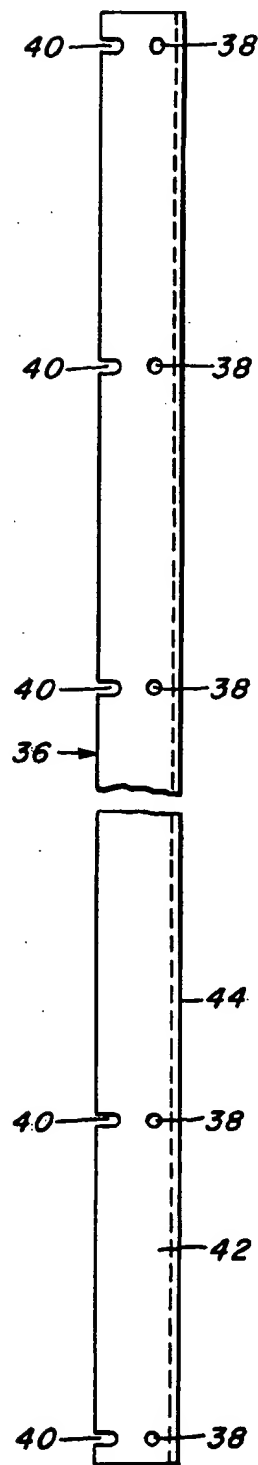


FIG. 4.

## FLEXIBLE GUIDING TRACK AND RELEASE MECHANISM FOR AN OVERHEAD ROLLING DOOR ASSEMBLY

### BACKGROUND OF THE INVENTION

Sectional and rolling overhead door structures have been used in the past in industrial applications where heavy truck traffic and the like is prevalent. The sectional elements of these doors, most often fabricated from steel, are interconnected or interlocked such that they may be moved between open and closed positions and conveniently stored at the former position by rolling or folding, as is well known. A custom-made rigid steel guide is located on either side of the door for guiding and supporting the sectional elements at and between their respective open and closed positions.

Due to the nature of the traffic common to the industrial sites, where such sectional and rolling overhead structures are employed, there exists the possibility that accidents will occur involving damage to individual elements of the door and to the rigid steel guides associated therewith. When a rolling door is damaged, or when the rigid steel guides are deformed, the door becomes inoperable. In many cases, the door is jammed partially open. In damp situations, prevalent in both winter and summer, this condition results in moisture condensing on product inventory and causing product damage. This is especially drastic in the steel industry where condensation on the product (such as steel coils) causes its subsequent rejection and necessitates its reprocessing at considerable financial loss.

The inoperable state of such doors exists for days and possibly weeks before proper repairs can be made. It is during this time that product damage, and possibly even theft occurs.

### SUMMARY OF THE INVENTION

The present invention is addressed to a sectional door assembly, of which the rolling overhead door is an example, including a flexible guide track located on both sides of the door for supporting and guiding the same between its open and closed positions. Additionally, the assembly includes a relatively quick release and securing mechanism for releasably securing the guide track to the frame structure located about the door periphery in such a manner as to provide for the relatively quick removal of the guide track from the frame. As a result, the sectional door elements may be quickly repaired or replaced and the guide track secured to the frame in a much shortened period of time.

The flexible nature of the guide track contributes to the minimizing of damage to the sectional door elements. This is accomplished by permitting the door elements to escape from the guide track when sufficient force is applied by accident to a door element or elements. Optimally, the force necessary to remove the elements from the flexible guide track will be smaller than that required to appreciably distort or ruin the door elements themselves. While particular circumstances may preclude such damage prevention operation of the guide track in some cases, the quick release nature of the securing mechanism for securing the guide track to the door frame provides for the relatively prompt substitution of the damaged door elements and subsequent reassembly of the door structure. Accordingly, the time during which the door structure is inop-

erable is minimized, thereby decreasing the possibility of product damage or theft during such occurrences.

It is therefore a primary object and feature of the present invention to provide a sectional door assembly including a flexible guide track for permitting the non-damaging removal of a sectional door element or elements from the guide track when the element or elements are accidentally struck with a given amount of force.

It is a general object and feature of the present invention to provide a quick release mechanism for a guide track incorporated within a sectional door assembly which provides for the relatively prompt removal of the guide track from its secured relationship with the door frame located about the periphery of the door opening.

It is another object and feature of the present invention to provide a sectional door assembly including a pair of flexible guide tracks positioned on both lateral sides of the sectional door for both guiding and supporting the plurality of sectional door elements between their respective open and closed positions, the flexible guide track being operative to permit the removal of sectional door elements from the guide track when they are accidentally hit with a sufficient force thereby minimizing damage to the sectional door elements, the guide track or the sectional door assembly as a whole.

Other objects and features of the invention will, in part, be obvious and will, in part, become apparent as the following description proceeds. The features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of the specification.

### BRIEF DESCRIPTION OF THE DRAWINGS

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its structure and its operation together with the additional objects and advantages thereof will best be understood from the following description of the preferred embodiment when read in conjunction with the accompanying drawings wherein:

FIG. 1 is an elevational view of the sectional door assembly of the present invention as seen from a position inside a building;

FIG. 2 is a sectional view of a releasable securing mechanism incorporated within the sectional door assembly shown in FIG. 1;

FIG. 3 is an enlarged detailed partial plan view of the releasable securing mechanism of FIG. 2; and

FIG. 4 is a full elevational view of a portion of one element of the releasable securing mechanism of FIG. 2.

### DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, there is shown a sectional door assembly 10 which is of the overhead rolling variety. Two frame structures, shown generally at 12 and 14, are located proximate the lateral periphery of an opening with which the door assembly is associated. The assembly 10 includes a door 16 composed of a plurality of interlocking steel slats or elements 18 which are movable between their respective closed positions, as shown in FIG. 1, to their "pen" position (not shown) in which the slats 18 are rolled into a convenient storage roll 20 positioned at the top of the door structure.

The specific elements for r lling the slats or door elements into their stored configuration include a motor 22, appropriate gear linkages 24, and a shaft 26 extending between opposite sides of the door opening. Due t the interl cking nature of the slats, as well as the flexible nature of the bottom portion 28 of door 16 (which in this preferred embodiment is a four-ply belt curtain) the door is easily moved to its stored position with a minimum of time and effort.

Support and guidance for the individual door elements is provided through a pair of flexible generally U-shaped guide tracks 30 and 32 located on either side of the door 16. Guide tracks 30 and 32 are attached to frame structures 12 and 14 as will be explained in detail below. In the preferred embodiment, tracks 30 and 32 are made of polyurethane of 90 durometer hardness. It should be apparent that other materials exhibiting a similar degree of flexibility might be used in lieu of polyurethane.

Reference is now made to FIGS. 2-4 wherein the specific detail of the guide track-frame interface structure is shown, and in which the "quick" release mechanism of the present invention is disclosed. FIG. 2 is a sectional view of the guide track and frame structure located on the right-hand side of door 16 as seen in FIG. 1. Due to the symmetrical nature of the two door sides, only one will be explained in detail.

The frame structure 14, shown in dashed lines, may take a variety of shapes and/or configurations as will become readily apparent to those skilled in the art. For purposes associated with this invention, it will suffice merely to recite that the frame structure is attached to the periphery of the door opening and provides support for the door supporting and guiding elements which are about to be described. It will aid clarity to the present embodiment to suggest that, in the preferred embodiment of the present invention, frame structure 14 is configured having a supporting wall surface 34 which is parallel to the door 16.

Attached to the surface 34, through any convenient and well known means, such as welding, is an L-shaped frame bracket or member 36. Bracket 36 is configured having an elongated length and includes a plurality of holes 38 and slots 40 formed in and properly spaced along one side 42 extending orthogonal to the plane of the door 16 (see FIG. 4). Should the frame structure 14 be configured having such an orthogonally extending side, then the structure of bracket 36 might be different in order to accommodate for such alterations. However, as presented, bracket 36, which extends at least the full height of the door 16, includes an orthogonal side 42 and a second side 44 oriented normal thereto.

Pivotaly mounted to side 42 of bracket 36 is a latch element 46. Latch element 46, mounted to bracket 36 through hole 38 by a nut and bolt arrangement 48, including a nut 50 and bolt 52, is movable between a "latched" position, as shown in solid lines in FIG. 3 to a number of "unlatched" positions, one of which is shown in phantom as at 46'. The latch element 46 basically includes a body having an arcuately shaped slot 54 formed therein as shown. Slot 54 is configured so as to be cooperable with a second bolt 56, which is connected to guide track 32 through a bore formed in the latter as shown in FIG. 2. When inserted within slot 40, the bolt 56, and its associated nut 58, may be "captured" by the arcuate slot 54 of latch element 46. This status is shown in solid lines in FIG. 3.

When the interlocking steel door slats 18 have been accidentally struck, they are displaced, in part, fr m the guide track 30 and/or 32 due to the latter's flexibility. If the force with which the slats 18 are struck is sufficient to damage them, it may be necessary to replace those door elements before the door can be operated again.

To replace the deformed or damaged slats, the series of two nuts 50 and 58, associated with bolts 52 and 56, respectively, are loosened along the entire length of bracket 36. The latch elements 46 are rotated from their latched positions to their unlatched position as indicated in FIG. 3. Next, the entire guide tracks 30 and 32 and their associated bolts 56 are removed from both sides of the door. The damaged door elements 18 are replaced with elements which have been stockpiled. With the door hanging free, the flexible guide tracks 30 and 22 are then replaced on each side and the bolts 56 are slipped into the slots 40 located in side 42 of bracket 36. Latches 46 are rotated into engagement with bolts 56 such that arcuate slots 54 of all the latches engage and capture bolts 56. Subsequently, nuts 50 and 58 are tightened and reassembly is complete.

It should be apparent that the flexible guide tracks and "quick" release retaining mechanism of the present sectional door assembly provide for several advantages over the prior art. In particular, the flexible guide tracks act as a cushion for any minor impact to the slats such that some damage is alleviated. Additionally, the flexible nature of the guide tracks provides for the release or escape of the slats from the guide tracks without damage to the guides. Moreover, the quick release mechanism for the guide track drastically reduces time required for door repairs by making the entire guide track readily removable. Lastly, the use of standard guide tracks and door slats permits the efficacious stockpiling of guides as well as slats for immediate use should the need arise.

While certain changes may be made in the above system and assembly without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A sectional door assembly comprising:

means defining a support frame located proximate the periphery of an opening with which said door assembly is associated;

means defining a door composed of a plurality of sections attached to one another such that they are collectively movable between an open position, for permitting entrance and egress through such opening, in which said plurality of sections are conveniently stored out of the path of entrance and egress, and a closed position, for denying entrance and egress, in which said plurality of sections are oriented in stacked parallel abutting fashion to one another for defining a door; and

means for supporting and guiding said plurality of sections at their ends at and between said open and closed positions, said supporting and guiding means including a flexible generally U-shaped guide track located n both sides f such opening, said flexible guide track b ing supported on b th sides of such opening substantially totally from the closed end thereof, said guide track having a greater flexibility than said sections, such that ne

5

from said sections retained within said guide track will be released from said flexible guide track, in either of the two directions which are orthogonal to the plane established by said sections in their closed positions, when a force is applied to said one or more of sections which is otherwise sufficient to flex said sections, said one or more sections being released from said generally U-shaped guide track before said sections are substantially flexed and possible damage results to said one or more sections or to said guide track.

2. The assembly of claim 1 in which said flexible guide track is formed from polyurethane.

3. The assembly of claim 1 in which said supporting and guiding means further includes means for releasably attaching said flexible guide track to said frame defining means such that a quick release of said flexible guide track from said frame defining means may be effected, thereby shortening repair time.

4. A sectional door assembly comprising:  
means defining a support frame located proximate the periphery of an opening with which said door assembly is associated,

means defining a door composed of a plurality of sections attached to one another such that they are collectively movable between an open position, for permitting entrance and egress through such opening, in which said plurality of sections are conveniently stored out of the path of entrance and egress, and a closed position, for denying entrance and egress, in which said plurality of sections are oriented in stacked parallel abutting fashion to one another for defining a door; and

means for supporting and guiding said plurality of sections at their ends at and between said open and closed positions, said supporting and guiding means including a flexible guide track located on both sides of such opening, said flexible guide track being configured to accommodate the forced removal of one or more of said plurality of sections from said guide track with minimum damage to said guide track and said one or more removed sections, said supporting and guiding means further including means for releasably attaching said flexible guide track to said frame defining means including:

extension means, attached to said flexible guide track, and extending from said flexible guide track in such a manner as to provide a convenient extension

6

through which said flexible guide track may be secured while avoiding interference with said supporting and guiding of said plurality of sections at their ends by said flexible guide track, said extension means being insertable within aperture defining means formed in a portion of said frame defining means; and

latch means, pivotally mounted to a portion of said frame defining means for movement between a latched position, in which said latch is in latching engagement with said extension means when said extension means is inserted within said aperture, for latching said extension means and said flexible guide track to said frame defining means, and an unlatched position, in which said latch means is out of latching engagement with said extension means such that said extension means, and said associated flexible guide track, may be conveniently and quickly removed from latched association with said frame defining means for effecting repairs to said door defining means or said flexible guide means.

5. A quick release attaching mechanism, for use with a sectional door guide track which supports and guides the elements of a sectional door, for releasably attaching such guide track to a frame located proximate the periphery of an opening with which the sectional door is associated, said quick release attaching mechanism comprising:

extension means, attached to such guide track, and extending from such guide track in a direction so as to provide a convenient extension through which such guide track may be secured while avoiding interference with the guiding and supporting operation of such guide track relative to the sectional door elements, said extension means being insertable within an aperture formed in a portion of such frame; and

latch means, pivotally mounted to a portion of the frame for movement between a latched position, in which said latch is in latching engagement with said extension means when said extension means is inserted within the aperture formed in such frame, and an unlatched position, in which said latch means is out of latching engagement with said extension means such that said extension means, and such associated guide track, may be conveniently and quickly removed from latched association with the frame for effecting repairs to the sectional door or to such guide track.

\* \* \* \* \*

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 4,016,920 Dated April 12, 1977

Inventor(s) James N. Shepard

It is certified that error appears in the above-identified patent  
and that said Letters Patent are hereby corrected as shown below:

Column 4, line 18, change "22" to -- 32 --.

Signed and Sealed this

twelfth Day of July 1977

[SEAL]

Attest:

RUTH C. MASON  
Attesting Officer

C. MARSHALL DANN  
Commissioner of Patents and Trademarks

## Iwasaki

**[11] Patent Number: 5,036,621**

[45] **Date of Patent:** Aug. 6, 1991

[54] SLIDING MEMBER FOR WINDOW  
REGULATOR

[75] Inventor: **Kenji Iwasaki, Nishinomiya, Japan**

**[73] Assignee: Nippon Cable System Inc.,  
Takarazuka, Japan**

**[21] Appl. No.: 551,377**

**[22] Filed: Jul. 11, 1990**

**[30] Foreign Application Priority Data**

Jul. 17, 1989 [JP] Japan ..... 64-83889[U]

[51] Int. Cl.<sup>5</sup> ..... E05D 15/16

[52] U.S. Cl. .... 49/428; 16/93 R;  
49/348; 49/375

[58] Field of Search ..... 49/428, 348, 349, 350,  
49/351, 352, 375, 374, 440, 502; 16/93 R

## [56] References Cited

## U.S. PATENT DOCUMENTS

3,466,803	9/1969	Packett .....	49/428 X
4,069,617	1/1978	Koike .....	49/428
4,503,639	3/1985	Rossie et al. ....	49/348 X
4,782,629	11/1988	Mori et al. ....	49/428
4,829,630	5/1989	Church et al. ....	49/428 X

## FOREIGN PATENT DOCUMENTS

2624028 12/1976 Fed. Rep. of Germany .

2836032 2/1980 Fed. Rep. of Germany .

8413286 6/1987 Fed. Rep. of Germany .

1447576 8/1976 United Kingdom .

**Primary Examiner—Philip C. Kannan**

**Attorney, Agent, or Firm—Armstrong, Nikaido, Marmelstein, Kubovcik, & Murray**

[57] **ABSTRACT**

A sliding member for a window regulator having a substantially vertical guide rail lip channel cross sectional shape. The sliding member is capable of sliding internally of the guide rail. A carrier plate has a shaft to support the sliding member and fixedly supports a window pane. The sliding member has a rigid body with guided surfaces facing to the guide rail and has protrusions made of elastic material which slidably contact the guide rail. The protrusions are located on a part of the guided surfaces of the sliding member. The sliding member minimizes pivotal instability of the carrier plate during sliding movement of the window pane.

**3 Claims, 5 Drawing Sheets**

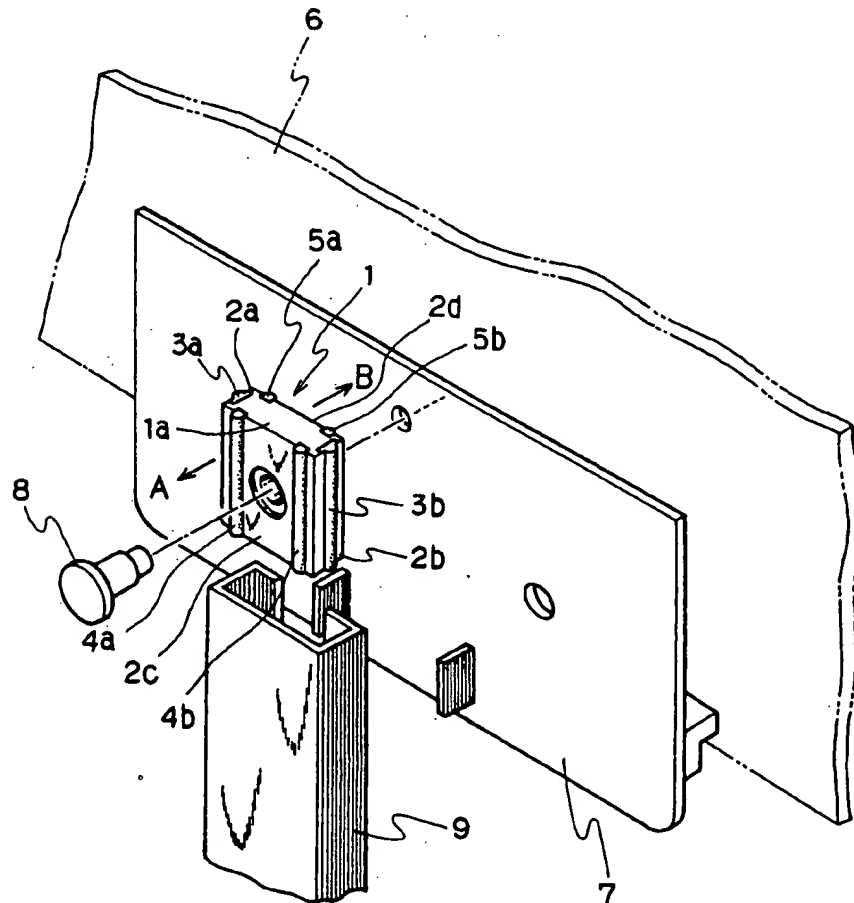




FIG. 1

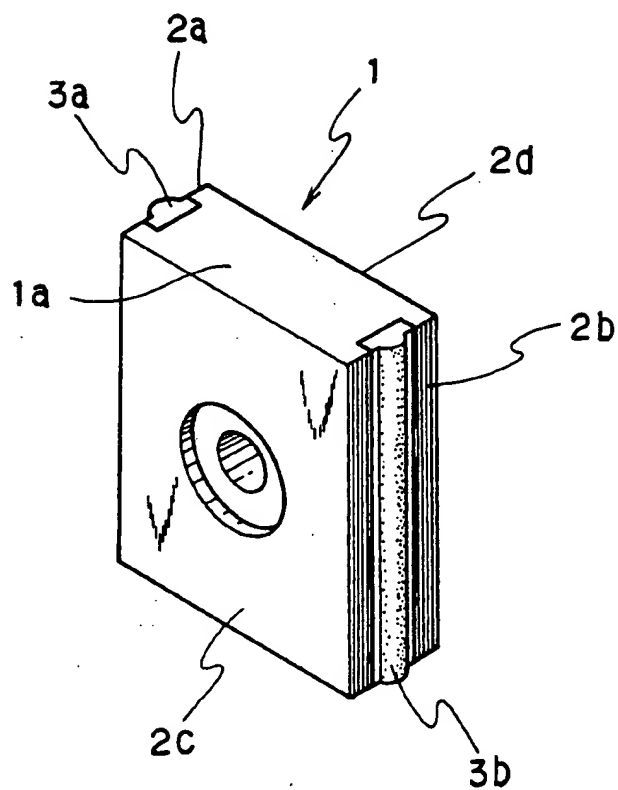


FIG. 2

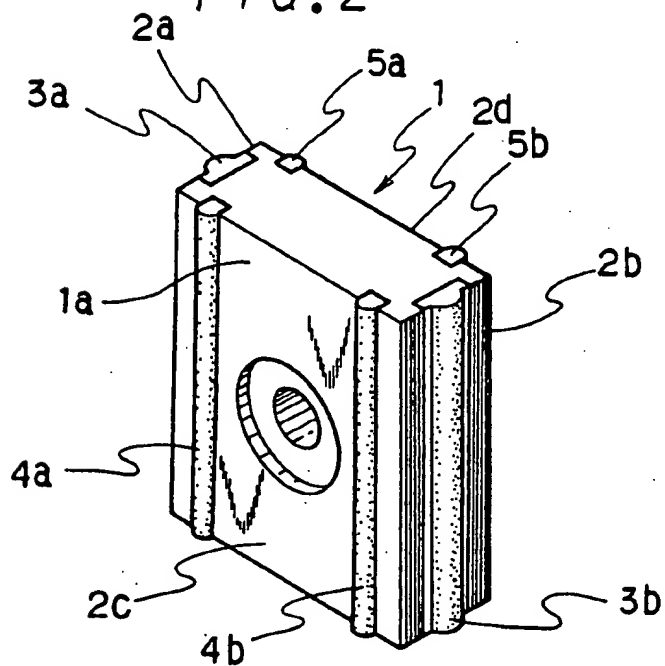


FIG. 3

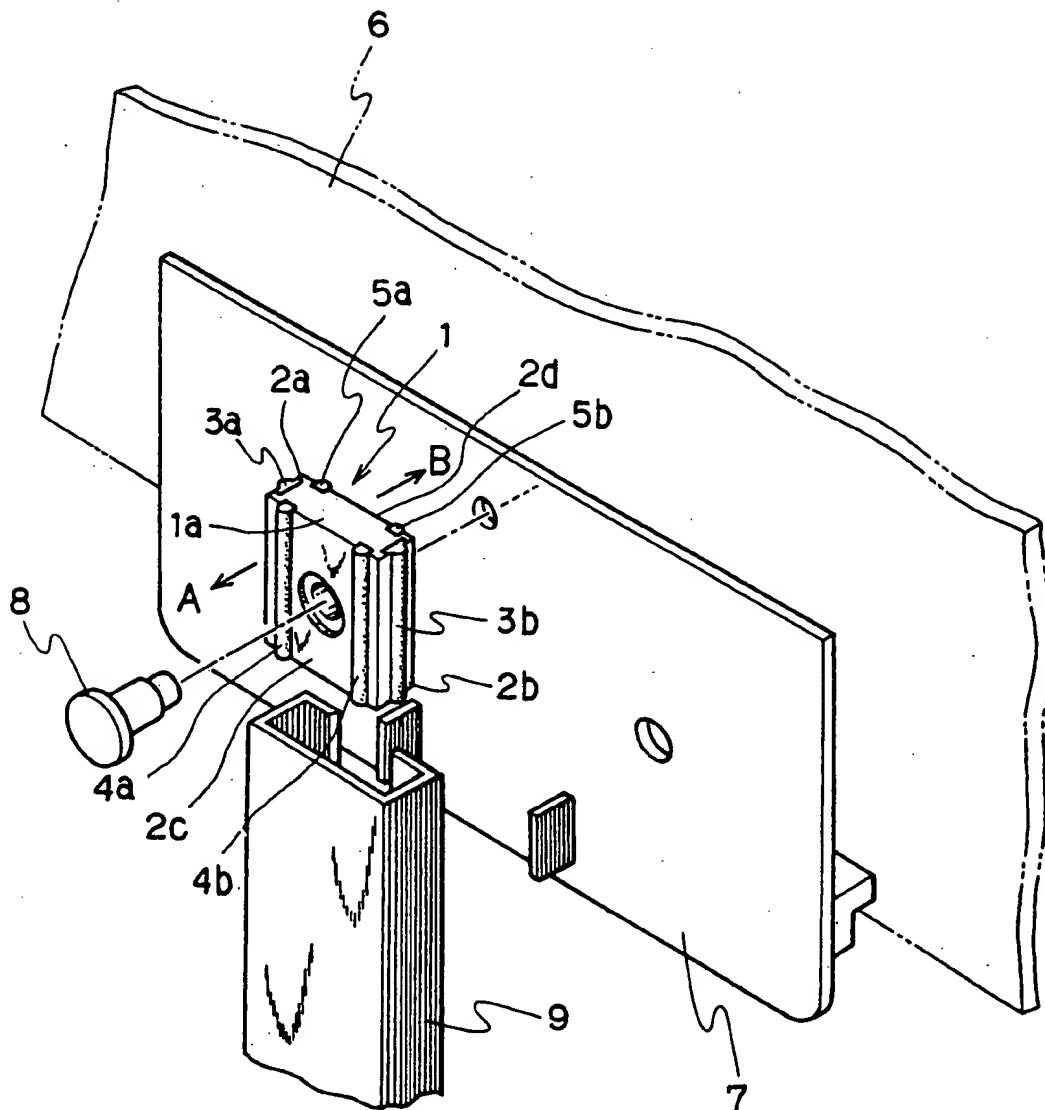


FIG. 4

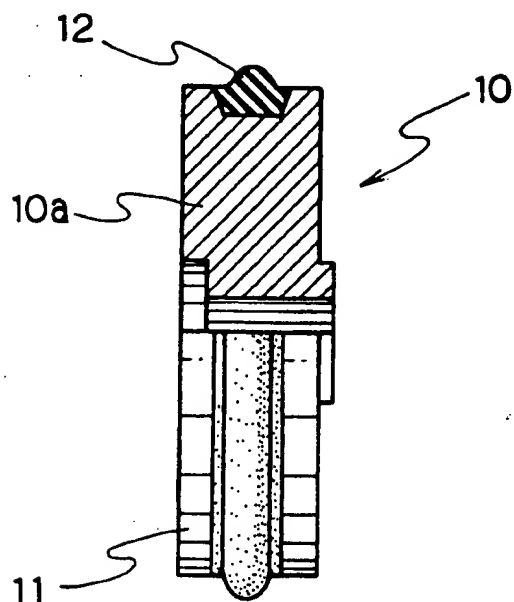


FIG. 5

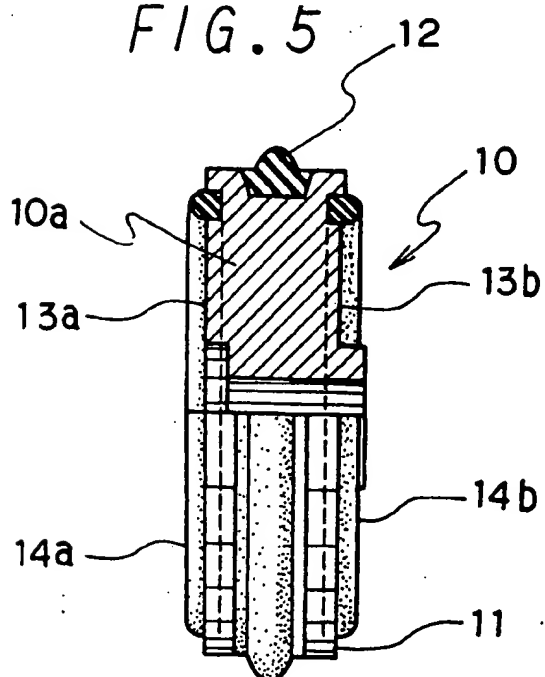


FIG. 6

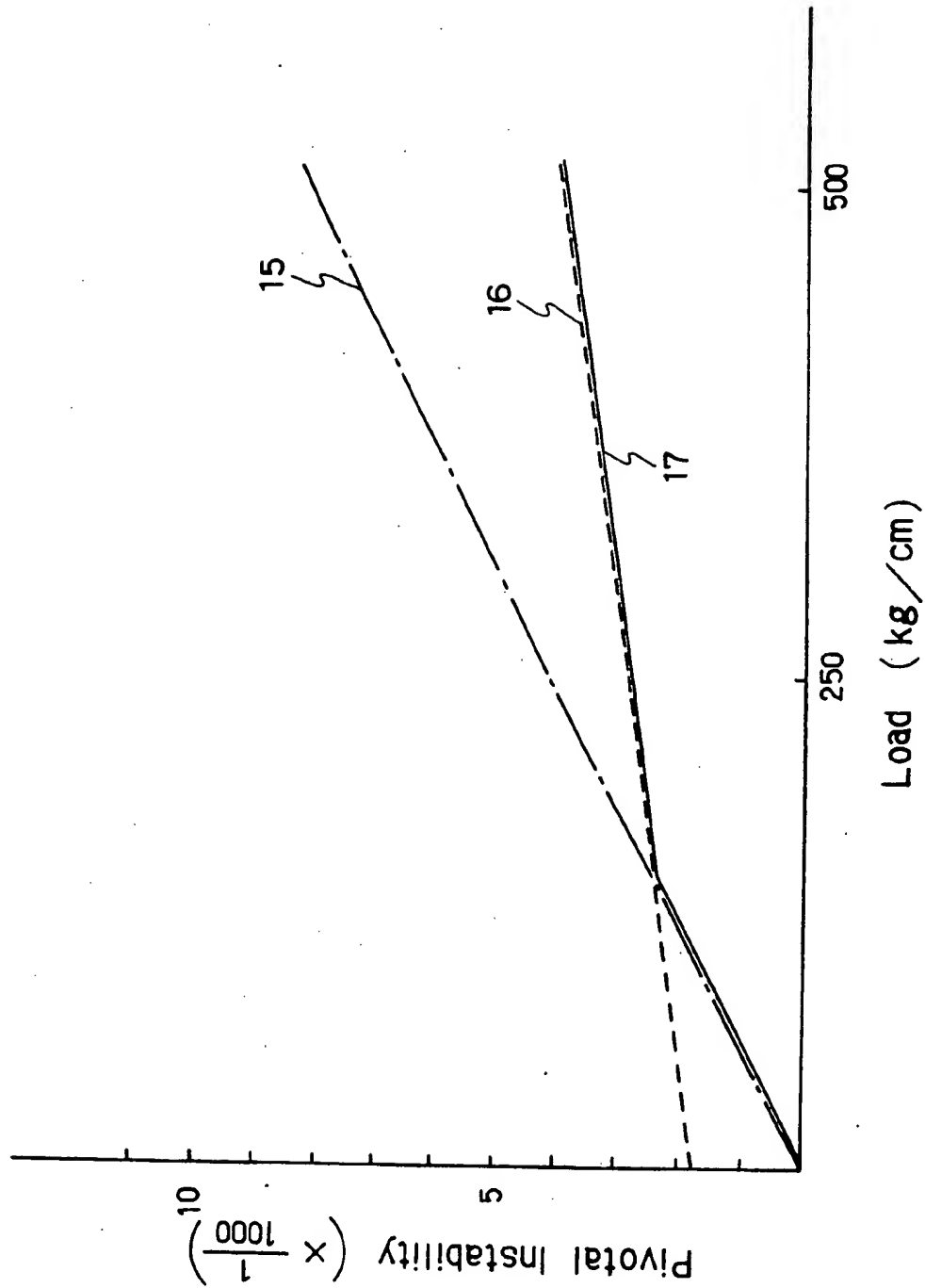
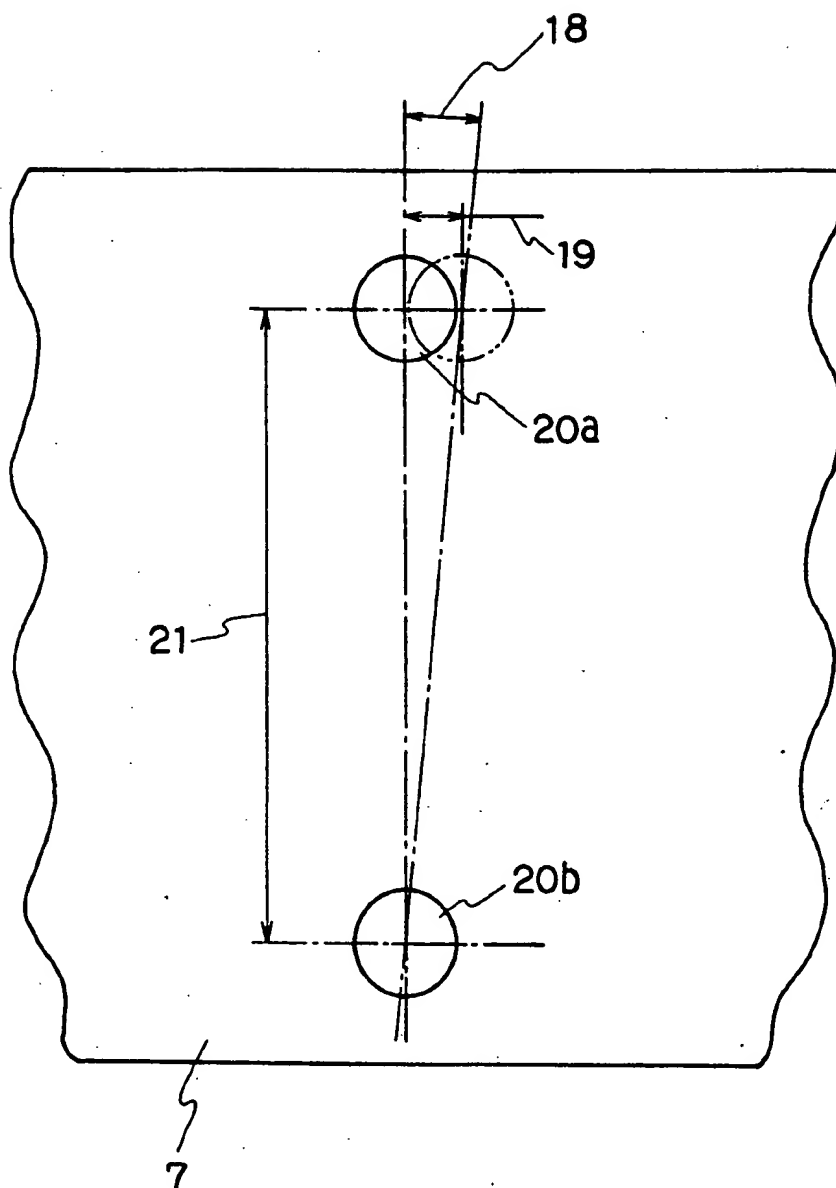


FIG. 7



## SLIDING MEMBER FOR WINDOW REGULATOR

## BACKGROUND OF THE INVENTION

The present invention relates to an improvement of a sliding member for a window regulator, and more particularly to an improvement of a sliding member capable of minimizing an instability of a sliding member relative to a guide rail.

With regard to a conventional window regulator which moves up and down a window pane for vehicles or the like by sliding to open or shut the window, there is employed for example a regulator having a construction in which a steel guide rail having a "lip channel steel" cross sectional shape (both sides are twice bent inwardly) is used and a sliding member capable of sliding along the inside of the guide rail is attached to a carrier plate.

The bending of the guide rail having the above-mentioned cross sectional shape is easy compared with guide rails having different cross sectional shape, so the guide rail having the above-mentioned cross sectional shape is widely used for a window regulator which needs to make a window pane slide along a three dimensional locus. In order that the carrier plate to which a window pane is attached can slide along the guide rail having the above-mentioned construction, the carrier plate is equipped with a pivotally attached sliding member made of metal or relatively hard synthetic resin to allow the guide plate to slide along the guide rail.

With regard to the conventional sliding member for a window regulator, metal or relatively hard thermoplastic resin (polyacetal or the like) is generally employed as the material to be used for the member. On the other hand, in another example of the conventional window regulator, a comparatively hard but elastic material, such as polyurethane, is used and its elasticity is effectively utilized.

The former sliding member is hardly bent even when a heavy load is applied onto it during sliding movement in the guide rail, so it can stand under a heavy load. However, a clearance to ensure a smooth initial sliding movement is required between the sliding member and the guide rail, though the required clearance is very small. This clearance causes a pivotal instability of the carrier plate supporting the window pane during its sliding movement, and thus there arises an inconvenience problem in the opening and shutting operation of the window pane.

On the other hand, the latter sliding member made of elastic polyurethane or the like does not cause a play initially in the sliding movement, but it has a drawback that a deformation takes place and consequently a pivotal instability of the carrier plate takes place when a heavy load is applied onto it.

Thus, the former and the latter respectively have both a merit and a demerit.

In this specification, the term "pivotal instability" is defined as follows (refer to FIG. 7):

$$\text{Pivotal Instability} = \frac{\text{lateral deflection of one sliding member}}{\text{span between two sliding member}}$$

An object of the present invention is to provide a sliding member capable of suppressing a pivotal instability at the initial sliding movement and another pivotal

instability caused by undersired deformation under a heavy load to a minimum load.

## SUMMARY OF THE INVENTION

There is provided in accordance with the present invention a sliding member for a window regulator which includes: a guide rail having a channel-with-lip type cross sectional shape disposed substantially vertical, a sliding member capable of sliding along an inside of the guide rail, a carrier plate onto which the sliding member is attached and a window pane is fixed, and a driving means for enabling the carrier plate to slide up and down along the guide rail, characterized in that the sliding member has a rigid body having a guided surface facing to the guide rail and at least one protrusion made of elastic material which contacts the guide rail slidably and the protrusion is located on a part of the guided surface preferably in such a manner that the protrusion prevents the rigid body from sliding directly on the guide rail under light load conditions. The term "light load", described here, means a load applied on a sliding member, for example, when a window regulator is at rest, or, at an initial sliding movement.

Preferably, the sliding member may have a rectangular side face configuration, and optionally may have additional protrusions made of elastic material on a part of both side faces preferably in such a manner that the additional protrusions prevent the rigid body from sliding directly on the guide rail under light load conditions.

Alternatively, the sliding member may have a roller-like or round shaped side face and an annular protrusion made of elastic material on the outside circumferential surface covering the full circumferential length, or, as occasion demands, may have additional ring-like protrusions made of elastic material on a part of both side faces of the sliding member which have a roller-like or round shaped configuration in such a manner that the protrusions prevent the rigid body from sliding on the guide rail.

In this specification, the term "side face" of the slidable member means a surface which is substantially parallel to the window pane and the carrier plate.

In a window regulator using the sliding member according to the present invention, any instability of the slidable member is not noticed even in the initial slidable movement of a window pane because the protrusion made of elastic material such as polyurethane is set to or contacts a part of the guided surface. Furthermore, the rigid body of the sliding member is made of relatively hard metal or thermoplastic resin, so it is hardly deformed and consequently the undesirable pivotal instability is minimized even under a heavy load applied occasionally.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing an embodiment of the sliding member having a side face of rectangular shape according to the present invention;

FIG. 2 is a perspective view showing another rectangular embodiment different from the embodiment shown in FIG. 1;

FIG. 3 is a schematic exploded perspective view of a window regulator showing an application of the slidable member according to the present invention;

FIG. 4 is a partially cutaway view showing another embodiment of the sliding member having a side face of round shape according to the present invention,

5,036,621

3

FIG. 5 is a partially cutaway view showing another embodiment of a round sliding member different from the embodiment shown in FIG. 4;

FIG. 6 is a graph showing the pivotal instability test result of the sliding member according to the present invention;

FIG. 7 is a schematic view explaining the pivotal instability.

#### DETAILED DESCRIPTION

The sliding member for a window regulator according to the present invention is explained below with reference to the drawings.

In FIG. 1, a sliding member 1 has a construction in which there is provided, on a rigid body 1a, protrusions 3a, 3b made of relatively hard elastic material such as polyurethane slidably contacting the guide rail at locations on both guided surface 2a, 2b facing the guide rail of the sliding member 1.

Further, a sliding member 1 in FIG. 2 has a construction in which there is provided on a rigid body 1a, in addition to the construction shown in FIG. 1, protrusions 4a, 4b, 5a, 5b made of relatively hard elastic material such as polyurethane for slidably contacting the guide rail at locations on different guided surfaces (or side faces) 2c, 2d of the slidable member 1.

Using the sliding member of the present invention having the above-mentioned construction, a pivotal instability test is carried out to compare the sliding member according to the present invention with the conventional ones. The test result is shown by means of a graph in FIG. 6.

As previously mentioned, during the sliding movement of the window pane the protrusions 3a, 3b made of elastic material such as polyurethane are in contact with the guide rail. Therefor, as demonstrated in the graph of FIG. 6 almost no pivotal instability is observed at the initial sliding movement by virtue of the characteristics of the sliding member made of elastic material (polyurethane).

Further, when a heavy load is applied to the window pane, the protrusions 3a, 3b having elasticity are so completely deformed that the rigid body 1a made of relatively hard thermoplastic resin (polyacetal or the like) of the sliding member 1 is allowed to be in direct contact the guide rail at regions without the elastic L protrusions 3a, 3b. As a result, there is not observed a pivotal instability of the carrier plate caused by an undesired deformation of the sliding member.

Thus, in accordance with the particular combination of two conventional sliding members, there can be obtained a meritorious novel sliding member having only the merits or advantages of both types of conventional sliding members.

In FIG. 6, the pivotal instability test data of the conventional sliding member made of polyurethane is represented by the line 15, the data of the conventional sliding member made of polyacetal is represented by the line 16 and the data of the sliding member of the present invention is represented by the line 17 respectively.

FIG. 7 is a schematic view explaining the pivotal instability, in which the pivotal instability ( $x/\text{span}$ ) is represented by the numeral 18, the lateral deflection ( $x$ ) of one sliding member is represented by the numeral 19, sliding members are represented by the numerals 20a, 20b and the span between two sliding members is represented by the numeral 21 respectively. In order to sim-

4

plify the drawing, the sliding members 20a, 20b are illustrated by circles.

Furthermore, by employing another construction as shown in FIG. 2 wherein protrusions 4a, 4b, 5a, 5b are provided on the side guided surfaces (side face) 2c, 2d in addition to the construction shown in FIG. 1, an instability (a play) in back and forth directions (directions represented by the arrows A and B in FIG. 3) can also be removed.

In FIG. 3, the numeral 6 represents a window pane, the numeral 7 represents a carrier plate, the numeral 8 represents a shaft to attach the sliding member 1 to the carrier plate 7, and the numeral 9 represents a guide rail.

Next, in the case that a roller-like, or round shaped, sliding member 10 is employed as shown in FIG. 4 and FIG. 5, the same advantageous result can be obtained by employing a construction in which an annular protrusion 12 made of elastic material slidably contacting the guide rail is provided on a part of the outside circumferential surface 11 of the rigid body 10a, or optionally a construction in which ring-like protrusions 14a, 14b are provided on side faces 13a, 13b.

Thus, each of the previously-mentioned advantages of the conventional sliding member made of relatively hard material and the conventional sliding member made of relatively hard but elastic material such as polyurethane makes up for the drawbacks of the other, and as a result, pivotal instability of the carrier plate during the sliding movement of the window pane can be greatly minimized.

It should be noted that the protrusions of the sliding member are not limited to protrusions having a continuous form as shown in FIG. 1 and FIG. 2, but a number of discontinuous local protrusions are also included within the principle of the present invention.

As described hereinbefore, the sliding member for a window regulator according to the present invention can bring an advantageous effect that a pivotal instability at the initial sliding movement is suppressed to a minimum and another pivotal instability caused by undesired deformation under a heavy load is also suppressed to a minimum.

What we claim is:

1. A sliding member for a window regulator, the window regulator comprising:

a substantially vertical guide rail having a lip channel type cross sectional shape, said guide rail having a first inner surface, a second and a third inner surface perpendicular to said first inner surface and extending respectively from right and left ends of said first inner surfaces to face each other, a fourth and a fifth inner surface parallel with said first inner surface and extending inwardly respectively from extended ends of said second and said third inner surfaces,

a sliding member capable of sliding along an inside of the guide rail, and

a carrier plate having a shaft supporting the sliding member and fixedly supporting a window pane, said carrier plate being capable of sliding up and down along the guide rail,

characterized in that the sliding member has a rigid body having five guided areas respectively guided by said first inner surface, said second inner surface, said third inner surface, said fourth inner surface and said fifth inner surface of said guide rail and a protrusion made of elastic material is provided on a part of each of said five guided areas,

5

each of said protrusions being located in such a manner that under light load conditions said protrusions prevent said rigid body from sliding directly on said inner surfaces of said guide rail and under heavy load conditions said rigid body is allowed to slide directly on said inner surfaces of said guide rail.

2. The sliding member of claim 1, wherein the sliding member has rectangular side faces.

6

3. The sliding member of claim 1, wherein the sliding member has opposed round-shaped side faces, a continuous annular protrusion is provided on a part of an outside circumferential surface of the sliding member and covers the full circumferential length of said outside circumferential surface and a ring shaped protrusion is provided on each of said opposed round-shaped side faces.

\* \* \* \* \*

10

15

20

25

30

35

40

45

50

55

60

65